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2001-241647	9 August 2001 (09.08.2001)	JP
2001-263525	31 August 2001 (31.08.2001)	JP
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2001-306282	2 October 2001 (02.10.2001)	JP
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2001-350076	15 November 2001 (15.11.2001)	JP
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60/337,157	10 December 2001 (10.12.2001)	US
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(54) Title: LIGHT EMITTING MATERIAL AND ORGANIC LIGHT-EMITTING DEVICE

(57) Abstract: A polymer light emitting material, wherein the material has a light emitting mechanism based on transition from an excited triplet state to a ground state or transition through an excited triplet state to a ground state of an electron energy level, and the material comprises a nonionic light emitting part which constitutes a part of the polymer or is bound to the polymer. The polymer light emitting material exhibits high light emission efficiency above 5 %, which is the limit of external quantum efficiency of fluorescence and can be designed so as to have a large area and hence are suitable for mass production of organic light emitting devices.

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A. CLASSIFICATION OF SUBJECT MATTER
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According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

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Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
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C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 01 41512 A (UNIV PRINCETON ;UNIV SOUTHERN CALIFORNIA (US)) 7 June 2001 (2001-06-07) abstract; claims page 12 -page 13	1,10-14, 32-34, 38,39
Y	--- -/--	1-45

[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

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Name and mailing address of the ISA	Authorized officer
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C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	BALDO M A ET AL: "High-efficiency fluorescent organic light-emitting devices using a phosphorescent sensitizer" NATURE, MACMILLAN JOURNALS LTD. LONDON, GB, vol. 403, no. 6771, 17 February 2000 (2000-02-17), pages 750-753, XP002183466 ISSN: 0028-0836 cited in the application page 751 page 753, column 1 ---	1-45
X	JUN C ET AL: "A NOVEL ORGANIC ELECTROLUMINESCENT DEVICE USING A NEW EU3+ POLYMER AS EMITTING LAYER" PROCEEDINGS OF THE SPIE, SPIE, BELLINGHAM, VA, US, vol. 4220, 8 November 2000 (2000-11-08), pages 255-259, XP008005362 page 255 -page 257	1-26, 32-45
Y	---	1-45
X	WO 00 26323 A (KATHIRGAMANATHAN POOPATHY ;SOUTH BANK UNIV ENTPR LTD (GB)) 11 May 2000 (2000-05-11) page 3 -page 6; claims ---	1,10-14, 32-34, 38,39
X	WO 00 70655 A (UNIV PRINCETON ;UNIV SOUTHERN CALIFORNIA (US)) 23 November 2000 (2000-11-23) page 14 -page 17; claims ---	1,10-14, 32-34, 38,39
X	EP 0 969 532 A (BAYER AG) 5 January 2000 (2000-01-05) abstract; claims 1,2,10,11 ---	1,10-14, 32-34, 38,39
Y	EP 0 612 772 A (BAYER AG) 31 August 1994 (1994-08-31) abstract; claims ---	1-45
X	YANG M-J ET AL: "USE OF POLY(9-VINYLCARBAZONE) AS HOST MATERIAL FOR IRIDIUM COMPLEXES IN HIGH-EFFICIENCY ORGANIC LIGHT-EMITTING DEVICES" JAPANESE JOURNAL OF APPLIED PHYSICS, PUBLICATION OFFICE JAPANESE JOURNAL OF APPLIED PHYSICS. TOKYO, JP, vol. 39, no. 8A, PART 2, 1 August 2000 (2000-08-01), pages L828-L829, XP001009235 ISSN: 0021-4922 abstract; figure 1 ---	1,10,14, 15,22, 32,35, 38,44

-/--

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication,where appropriate, of the relevant passages	Relevant to claim No.
Y	YANG M ET AL: "MONOCHROMATIC-RED-LIGHT EMISSION OF NOVEL COPOLYMERS CONTAINING CARBAZOLE UNITS AND EUROPIUM-ACRYLATE COMPLEXES" JOURNAL OF POLYMER SCIENCE, POLYMER CHEMISTRY EDITION, JOHN WILEY AND SONS. NEW YORK, US, vol. 38, no. 18, 15 September 2000 (2000-09-15), pages 3405-3411, XP001086543 ISSN: 0887-624X abstract page 3406; figure 1	1-45
P,X	US 2001/019782 A1 (KIMURA KEIZO ET AL) 6 September 2001 (2001-09-06) page 10 -page 17; claims page 20, paragraphs 114,115	1,10-14, 32-34, 38,39
P,Y	US 2001/015432 A1 (IGARASHI TATSUYA) 23 August 2001 (2001-08-23) page 3, column 2, paragraph 23	1-45
P,X	PATENT ABSTRACTS OF JAPAN vol. 2000, no. 24, 11 May 2001 (2001-05-11) -& JP 2001 181616 A (FUJI PHOTO FILM CO LTD), 3 July 2001 (2001-07-03) cited in the application	1,10-14, 32-34, 38,39
P,Y	abstract	1-45
P,X	PATENT ABSTRACTS OF JAPAN vol. 2000, no. 26, 1 July 2002 (2002-07-01) -& JP 2001 247859 A (FUJI PHOTO FILM CO LTD), 14 September 2001 (2001-09-14) cited in the application	1,10-14, 32-34, 38,39
P,Y	abstract	1-45
P,X	EP 1 245 659 A (SUMITOMO CHEMICAL CO) 2 October 2002 (2002-10-02) page 3 -page 9 page 11 -page 13 claims 27-31	1-45
P,X	EP 1 138 746 A (SUMITOMO CHEMICAL CO) 4 October 2001 (2001-10-04) abstract; claims page 15 page 4 page 17, line 49 - line 53	1-45

-/--

INTERNATIONAL SEARCH REPORT

International Application No
PCT/JP [redacted]6139

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
P,X	US 2001/030325 A1 (SUN RUN G ET AL) 18 October 2001 (2001-10-18) abstract; claims 1-17; figures 1-3	1-26, 32-45
E	WO 02 068435 A (COVION ORGANIC SEMICONDUCTORS ;BECKER HEINRICH (DE); SPREITZER HUB) 6 September 2002 (2002-09-06) abstract; claims 1,24-28	1-45

Form PCT/ISA/210 (continuation of second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No
PCT/JP 02/06139

Patent document cited in search report		Publication date	Patent family member(s)		Publication date
WO 0141512	A	07-06-2001	AU	1807201 A	12-06-2001
			EP	1252803 A1	30-10-2002
			WO	0141512 A1	07-06-2001
			US	2003017361 A1	23-01-2003
			US	2002034656 A1	21-03-2002
WO 0026323	A	11-05-2000	AU	754481 B2	14-11-2002
			AU	1056200 A	22-05-2000
			BR	9915252 A	04-12-2001
			CN	1325431 T	05-12-2001
			EP	1131388 A1	12-09-2001
			WO	0026323 A1	11-05-2000
			JP	2002528633 T	03-09-2002
WO 0070655	A	23-11-2000	AU	5004700 A	05-12-2000
			BR	0010424 A	13-02-2002
			WO	0070655 A2	23-11-2000
			US	2003017361 A1	23-01-2003
			US	2002034656 A1	21-03-2002
EP 0969532	A	05-01-2000	DE	19829948 A1	05-01-2000
			EP	0969532 A2	05-01-2000
			JP	2000048960 A	18-02-2000
			KR	2000011464 A	25-02-2000
			TW	419928 B	21-01-2001
EP 0612772	A	31-08-1994	DE	4305959 A1	01-09-1994
			DE	59402958 D1	10-07-1997
			EP	0612772 A1	31-08-1994
			JP	6256429 A	13-09-1994
			US	5442021 A	15-08-1995
US 2001019782	A1	06-09-2001	JP	2001345183 A	14-12-2001
			JP	2001247859 A	14-09-2001
US 2001015432	A1	23-08-2001	JP	2002302671 A	18-10-2002
JP 2001181616	A	03-07-2001	NONE		
JP 2001247859	A	14-09-2001	US	2001019782 A1	06-09-2001
EP 1245659	A	02-10-2002	EP	1245659 A1	02-10-2002
			US	2002193532 A1	19-12-2002
EP 1138746	A	04-10-2001	EP	1138746 A1	04-10-2001
			JP	2001342459 A	14-12-2001
			US	2002027623 A1	07-03-2002
US 2001030325	A1	18-10-2001	AU	5695401 A	17-09-2001
			WO	0167822 A1	13-09-2001
WO 02068435	A	06-09-2002	DE	10109027 A1	05-09-2002
			WO	02068435 A1	06-09-2002